UNIVERSITI PUTRA MALAYSIA

REVISION OF THE GENUS ERIA (ORCHIDACEAE) IN PENINSULAR MALAYSIA

TANG CHER HING.

REVISION OF THE GENUS *ERIA* (ORCHIDACEAE) IN PENINSULAR MALAYSIA

By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fufilment of the Requirements for the Degree of Master of Science

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Chair: Associate Professor Rusea Go, PhD

Faculty: Science

The genus *Eria* which was reported consists of 49 species in 11 sections in Peninsular Malaysia was revised. Findings from previous studies, ranging from diversity, vegetative architecture to molecular and morphological evidences have been used to solve the taxonomic problems in this genus. However, the sections and species delimitation for genus *Eria* are still obscure especially Section *Aeridostachya*, *Urostachya*, *Mycaranthes* and *Hymeneria,* despite of the many approaches attempted to delimit them. This study was carried out based on traditional taxonomic analysis on fresh and dried herbarium specimens and spirited collections targeted to investigate and gather as much as possible gross morphological characteristics of vegetative and floral organs that could be utilized to delimit sections and species of *Eria* in Peninsular Malaysia. The vegetative characters investigation includes the growth habit, stem or pseudoulbs and leaves whilst; the floral characters include the inflorescences, the

details of flower parts like sepals, petals and lip. There are two types of growth habit observed, the creeping and aggregate either with stems or pseudobulbs. A total of six leaf shape found, which are attached to the stem or peseudobulb by sheathing or auriculate-clasping. The investigation on the inflorescence shows that *Eria* has four inflorescence types, the solitary, bifloral, raceme and compound corymb. The inflorescence insertions were observed with three kinds, the terminal, subterminal and axillary. The flower characteristics include the shape of the flower, lip and pollinia has been studied under the light microscope for each species from every section. The ventral lip surface and pollen were studied under the Scanning Electron Microscope (SEM). There are 11 types of flower shapes representing each section ranging from Stellate A, Stellate B, Stellate C, Stellate D, Stellate E, Palmate, Campanulate A, Campanulate B, Campanulate C, Conical and Peltate. There are 11 types of lip shape representing each section, ranging from hastate, praemorse, lingulate, obovate, 'pendulum' shape, rotund, 'tie' shape, obstrullate, 'mushroom' shape, lobatus and rhomboid. Five types of pollinia shapes have been discovered are clavate, conical, square, narrow pyriform and compress conical. The flower shape and lip shape are good characters for section delimitation, while the pollinia shape is a good character for species delimitation. The SEM on pollen for *Eria* shows similar results for all species, the monolete shape with irregular ridges of sexine and laevigate sculpture, thus SEM on *Eria* pollen is a bad character for species and section delimitation. The SEM on ventral lip surface for *Eria* shows homogeneous or heterogeneous glabrous or with six types of papillae hairs. The shape of the papillae hairs are conical, narrow spatulate, broad spatulate, spherical, clavate and villiform. The SEM for ventral lip

surface is bad taxonomic character for species and section delimitation. *E. ochracea* is added as a new record for Peninsular Malaysia. The taxonomic keys were successfully developed using the vegetative and floral characteristics gathered in this study.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

REVISI PADA GENUS *ERIA* (ORCHIDACEAE) DI SEMENANJUNG MALAYSIA

Oleh

TANG CHER HING

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Pengerusi: Profesor Madya Rusea Go, PhD

Fakulti: Sains

Genus *Eria* yang dilaporkan mempunyai 48 spesies daripada 11 seksyen di Semenanjung Malaysia telah direvisikan. Keputusan daripada kajian dahulu, merangkumi diversiti, arkitektur vegetatif ke molekular dan bukti morfologi telah digunakan untuk menyelesaikan masalah taksonomi dalam genus ini. Akan tetapi, delimitasi spesies dan seksyen untuk genus *Eria* masih kabur terutama Seksyen *Aeridostachya*, *Urostachya*, *Mycaranthes* dan *Hymeneria* walaupun banyak pendekatan percubaan untuk memisahkan mereka. Kajian ini dijalan berdasarkan analisis taksonomi tradisional pada herbarium spesimen yang segar, kering dan koleksi dalam alkohol bertujuan untuk menyiasat dan mengumpul seberapa banyak morfologi luaran untuk ciri-ciri vegetatif dan organ bunga yang mungkin boleh digunakan untuk memisahkan seksyen dan spesies *Eria* di Semenanjung Malaysia. Penyiasatan ciri-ciri vegetatif merangkumi cara pertumbuhan, batang atau pseudobulb dan daun sebaliknya,

ciri-ciri bungaan termasuk infloresen, ciri-ciri terperinci pada bahagian bunga, seperti sepals, petals dan lip. Terdapat dua jenis cara pertumbuhan diperhatikan, iaitu menjalar dan berkelompok samaada dengan batang atau pseudobulb. Sejumlah enam bentuk daun dijumpai, iaitu melekat pada batang atau pseudobulb dengan cara menutup atau aurikulat-klasping. Penyiasatan pada infloresen menunjukkan bahawa *Eria* mempunyai empat jenis infloresen, iaitu sekuntum, dua bungaan, raceme dan kompaun korim. Kemasukan infloresen telah diperhati dengan tiga jenis, iaitu termina, sub termina dan axilari. Ciri-ciri bunga termasuk bentuk bunga, lip dan pollinia untuk setiap spesies daripada setiap seksyen telah dikaji dengan menggunakan mikroskop cahaya. Permukaan lip ventral dan debunga telah dikaji di bawah Scanning Electron Microscope (SEM). Terdapat sebelas bentuk bunga mewakili setiap seksyen merangkumi dari Stelat A, Stelat B, Stelat C, Stelat D, Stelat E, Palmat, Kampanulat A, Kampanulat B, Kampanulat C, Konikal dan Peltat. Terdapat sebelas bentuk lip mewakili setiap seksyen, merangkumi hastat, praemors, lingulat, obovat, bentuk 'pendulum', rotun, bentuk 'tie', obstrulat, bentuk 'cendawan', lobatus dan romboid. Lima bentuk pollinia telah ditemui, iaitu clavat, konikal, segi empat, pirifom sempit dan kompres konikal. Bentuk bunga dan lip adalah ciri-ciri yang baik untuk delimitasi seksyen, manakala bentuk pollinia adalah ciri yang baik untuk delimitasi spesies. SEM debunga untuk *Eria* menunjukkan keputusan yang sama untuk semua spesies, iaitu bentuk monolet dengan kedutan seksin yang tidak seragam dan skultur laevigat, maka SEM pada debunga *Eria* satu ciri yang teruk untuk delimitasi spesies dan seksyen. SEM pada permukaan ventral lip untuk *Eria* menunjukkan homogenus dan heterogenus glabos atau dengan enam jenis rambut papila. Bentuk rambut papila

adalah konikal, spatulat sempit, spatulat lebar, sferikal, clavat dan vilifom. SEM untuk permukaan ventral lip adalah ciri taksonomi yang teruk untuk delimitasi spesies dan seksyen. *E. ochracea* telah ditambah sebagai rekod baru untuk Semenanjung Malaysia. Kekunci taxonomi telah berjaya dibina dengan menggunakan ciri-ciri vegetatif and bungaan yang dikumpul dalam kajian ini.

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I certify that an Examination Committee has met on date of viva voce to conduct the final examination of Tang Cher Hing on his Master of Science thesis entitled "Revision of the Genus *Eria* (Orchidaceae) in Peninsular Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date: 10 April 2008

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

TANG CHER HING

Date: 24/6/2009

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LIST OF ABBREVIATIONS

Asl.	Above Sea level
Bkt.	Bukit
CITES	Convention on International Trade in Endangered Species
Cont.	Continue
FRIM	Forest Research Institute Malaysia
Ft.	Feet
G.	Gunung
ITS	Internal Transcribed Spacers
IUCN	International Union for Conservation of Nature
MARDI	Malaysia Agriculture Research and Development Institute
NA	Not available
SEM	Scanning Electron Microscope
Sg.	Sungai
s. l.	*sensu lato*
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UPM	Universiti Putra Malaysia
*	without flower
**	without specimen
&	and

CHAPTER 1

INTRODUCTION

1.1 General introduction

Orchidaceae is the most diverse and widespread family in the flowering plant kingdom and has attracted most botanists world wide. Over the years, extensive study has been carried out in this family, ranging from diversity to morphology and genetic, specifically phylogenetics for taxonomy. Generally, the total world orchid was estimated from 25,000 to 35,000 species. Peninsular Malaysia itself comprises about 854 species while Sabah and Sarawak contribute 3000 species.

Their distribution in Peninsular Malaysia range from lowland to highland forests or even at extreme habitats like peat swamps or limestone forests. Most of the orchid species found in Peninsular Malaysia are the epiphytic type. Different from the hybrid orchids, the size and shape of the plants as well as the flowers of wild orchids vary between species. Due to the uniqueness of the plant and the flower, wild orchids in Malaysia have become highly in demand in the market.

Eria is one of the genera which is widespread in Peninsular Malaysia. There are about 48 species being recorded by botanists, but the number of species occurring might increase in the future. The *Eria* flowers are usually small but they are attractive and